

CLAIMS

1. Thermoplastic material comprising:
 - (a) from 5% by weight to 95% by weight of a vulcanized rubber in a subdivided form;
 - 5 (b) from 5% by weight to 95% by weight of at least one heterophase copolymer comprising a thermoplastic phase made from a propylene homopolymer or copolymer and an elastomeric phase made from a copolymer of ethylene with an α -olefin;
 - 10 (c) from 0% by weight to 90% by weight of at least one α -olefin homopolymer or copolymer different from (b);the amounts of (a), (b) and (c) being expressed with respect to the total weight of (a) + (b) + (c).
 - 15 2. Thermoplastic material according to claim 1, wherein the vulcanized rubber in a subdivided form (a) is present in an amount of from 10% by weight to 60% by weight with respect to the total weight of (a) + (b) + (c).
 - 20 3. Thermoplastic material according to claim 1 or 2, wherein the heterophase copolymer (b) is present in an amount of from 40% by weight to 90% by weight with respect to the total weight of (a) + (b) + (c).
 - 25 4. Thermoplastic material according to any one of the preceding claims, wherein the α -olefin homopolymer or copolymer (c), is present in an amount of from 0% by weight to 50% by weight with respect to the total weight of (a) + (b) + (c).
 - 30 5. Thermoplastic material according to any one of the preceding claims, wherein, the vulcanized rubber in a subdivided form (a) has a particle size not higher than 10 mm.
 - 35 6. Thermoplastic material according to claim 5, wherein, the vulcanized rubber in a subdivided form (a) has a particle size not higher than 5 mm.

7. Thermoplastic material according to any one of claims 1 to 4, wherein the vulcanized rubber in a subdivided form (a) has a particle size not higher than 0.6 mm.
8. Thermoplastic material according to claim 7, wherein 5 the vulcanized rubber in a subdivided form (a) has a particle size not higher than 0.5 mm.
9. Thermoplastic material according to claim 8, wherein the vulcanized rubber in a subdivided form (a) has a particle size not higher than 0.2 mm.
10. Thermoplastic material according to any one of the preceding claims, wherein the vulcanized rubber in a subdivided form (a) comprises at least one diene elastomeric polymer or copolymer of natural origin or obtained by solution polymerization, emulsion 15 polymerization or gas-phase polymerization of one or more conjugated diolefins, optionally blended with at least one comonomer selected from monovinylarenes and/or polar comonomers in an amount of not more than 60% by weight.
20. Thermoplastic material according to claim 10, wherein the diene elastomeric polymer or copolymer is selected from: cis-1,4-polyisoprene, 3,4-polyisoprene, polybutadiene, optionally halogenated isoprene/isobutene copolymers, 1,3- 25 butadiene/acrylonitrile copolymers, styrene/1,3-butadiene copolymers, styrene/1,3-butadiene/acrylonitrile copolymers, or mixtures thereof.
30. Thermoplastic material according to any one of the preceding claims, wherein the vulcanized rubber in a subdivided form (a) comprises at least one elastomeric polymer of one or more monoolefins with an olefinic comonomer or derivatives thereof.
35. Thermoplastic material according to claim 12, wherein the elastomeric polymer is selected from:

ethylene/propylene copolymers (EPR) or ethylene/propylene/diene copolymers (EPDM); polyisobutene; butyl rubbers; halobutyl rubbers, in particular chlorobutyl or bromobutyl rubbers; or mixtures thereof.

5 14. Thermoplastic material according to any one of the preceding claims, wherein the thermoplastic phase of the heterophase copolymer (b) consists of a propylene homopolymer or a copolymer of propylene with an
10 olefinic comonomer selected from ethylene and α -olefins other than propylene.

15 15. Thermoplastic material according to claim 14, wherein the olefinic comonomer is ethylene.

16. Thermoplastic material according to claim 14 or 15,
15 wherein the olefinic comonomer is less than 10 mol% relative to the total number of monomer moles in the thermoplastic phase.

20 17. Thermoplastic material according to any one of the preceding claims, wherein the elastomeric phase of the heterophase copolymer (b) is at least 10% by weight relative to the total weight of the heterophase copolymer.

25 18. Thermoplastic material according to claim 17, wherein the elastomeric phase of the heterophase copolymer (b) is at least 40% by weight relative to the total weight of the heterophase copolymer.

19. Thermoplastic material according to claim 18, wherein the elastomeric phase of the heterophase copolymer (b) is at least 60% by weight relative to the total weight
30 of the heterophase copolymer.

20. Thermoplastic material according to any one of the preceding claims, wherein the elastomeric phase of the heterophase copolymer (b) consists of an elastomeric copolymer of ethylene with an α -olefin and optionally
35 with a polyene.

21. Thermoplastic material according to claim 20, wherein the α -olefin is propylene.
22. Thermoplastic material according to claim 20 or 21, wherein the polyene is a diene selected from:
5 linear (non-)conjugated diolefins; monocyclic or polycyclic dienes.
23. Thermoplastic material according to any one of claims 17 to 22, wherein the elastomeric phase has the following composition: from 15 mol% to 85 mol% of ethylene of an α -olefin; from 0 mol% to 5 mol% of a diene.
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24. Thermoplastic material according to any one of claims 17 to 23, wherein the elastomeric phase consists of an elastomeric copolymer of ethylene and propylene having the following composition: from 15% by weight to 80% by weight of ethylene; from 20% by weight to 85% by weight of propylene, with respect to the total weight of the elastomeric phase.
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25. Thermoplastic material according to claim 24, wherein the elastomeric phase consists of an elastomeric copolymer of ethylene and propylene having the following composition: from 20% by weight to 40% by weight of ethylene; from 60% by weight to 80% by weight of propylene, with respect to total the weight of the elastomeric phase.
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26. Thermoplastic material according to any one of the preceding claims, wherein in the homopolymer or copolymer (c) the α -olefin is an aliphatic α -olefin of formula $\text{CH}_2=\text{CH}-\text{R}$, wherein R represents a hydrogen atom, a linear or branched alkyl group containing from 1 to 12 carbon atoms; or an aromatic α -olefin of formula $\text{CH}_2=\text{CH}-\text{R}'$, wherein R' represents an aryl group having from 6 to 14 carbon atoms.
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27. Thermoplastic material according to claim 26, wherein the aliphatic α -olefin is selected from: ethylene,
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propylene, 1-butene, isobutylene, 1-pentene, 1-hexene, 3-methyl-1-butene, 3-methyl-1-pentene, 4-methyl-1-pentene, 4-methyl-1-hexene, 4,4-dimethyl-1-hexene, 4,4-dimethyl-1-pentene, 4-ethyl-1-hexene, 3-ethyl-1-hexene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, 1-octadecene, 1-eicosene, or mixture thereof.

5 28. Thermoplastic material according to claim 26, wherein the aromatic α -olefin is selected from: styrene, α -methylstyrene, or mixtures thereof.

10 29. Thermoplastic material according to any one of the preceding claims, wherein in the homopolymer or copolymer (c), the polyene is a conjugated or non-conjugated diene, triene or tetraene.

15 30. Thermoplastic material according to any one of the preceding claims, wherein the homopolymer or copolymer (c) is selected from:

- propylene homopolymers or copolymer of propylene with ethylene and/or an α -olefin having from 4 to 20 12 carbon atoms with an overall content of ethylene and/or α -olefin lower than 10% by mole;
- ethylene homopolymers or copolymers of ethylene with at least one α -olefin having from 4 to 12 carbon atoms;
- 25 - styrene polymers such as styrene homopolymers; styrene homopolymers modified with a natural or synthetic elastomer such as polybutadiene, polyisoprene, butyl rubber, ethylene/propylene/diene copolymer (EPDM),
- 30 ethylene/propylene copolymers (EPR) natural rubber, epichloridrin; styrene copolymers such as styrene-methylstyrene copolymer, styrene-isoprene copolymers, or styrene-butadiene copolymer;
- copolymers of ethylene with at least one ethylenically unsaturated ester selected from:

alkyl acrylates, alkyl methacrylates and vinyl carboxylate, wherein the alkyl group, linear or branched, has from 1 to 8 carbon atoms, while the carboxylate group, linear or branched, has from 2 to 8 carbon atoms; and wherein the ethylenically unsaturated ester is generally present in an amount of from 0.1% to 80% by weight with respect to the total weight of the copolymer.

10 31. Thermoplastic material according to claim 30, wherein
the ethylene homopolymers or copolymers of ethylene
with at least one α -olefin having from 4 to 12 carbon
atoms are selected from: low density polyethylene
(LDPE), medium density polyethylene (MDPE), high
density polyethylene (HDPE), linear low density
polyethylene (LLDPE), ultra-low density polyethylene
(ULDPE), or mixtures thereof.

15 32. Thermoplastic material according to claim 30, wherein
the styrene polymers are: syndiotactic polystyrene,
atactic polystyrene, isotactic polystyrene,
polybutadiene-modified styrene polymer, styrene-
butadiene copolymer, styrene-isoprene, or mixtures
thereof.

20 33. Thermoplastic material according to claim 30, wherein
the copolymers of ethylene with at least one α -olefin
having from 4 to 12 carbon atoms are selected from:
- elastomeric copolymers having the following
monomer composition: 35 mol%-90 mol% of ethylene;
10 mol%-65 mol% of an aliphatic α -olefin; 0 mol%
10 mol% of a polyene;
25 - copolymers having the following monomer
composition: 75 mol%-97 mol% of ethylene; 3 mol%
25 mol% of an aliphatic α -olefin; 0 mol%-5 mol%
a polyene.

30 34. Thermoplastic material according to claim 30, wherein
the copolymers of ethylene with at least one

5 ethylenically unsaturated ester are selected from:
ethylene/vinylacetate copolymer (EVA),
ethylene/ethylacrylate copolymer (EEA),
ethylene/butylacrylate copolymer (EBA), or mixtures
thereof.

10 35. Thermoplastic material according to any one of the preceding claims, wherein the homopolymer or copolymer (c) is present in an amount not lower than 5% by weight with respect to the total weight of (a) + (b) + (c).

15 36. Thermoplastic material according to claim 35, wherein the homopolymer or copolymer (c) is present in an amount not lower than 10% by weight with respect to the total weight of (a) + (b) + (c).

20 37. Thermoplastic material according to any one of the preceding claims, further comprising at least one coupling agent (d).

25 38. Thermoplastic material according to claim 37, wherein the coupling agent (d) is selected from: silane compounds containing at least one ethylenic unsaturation and at least one hydrolyzable group; epoxides containing at least one ethylenic unsaturation; monocarboxylic acids or, preferably, dicarboxylic acids having at least one ethylenic unsaturation, organic titanates, zirconates or aluminates; or derivatives thereof.

30 39. Thermoplastic material according to claim 37 or 38, wherein the coupling agent (d) is added in an amount of from 0.01% by weight to 10% by weight with respect to 100 parts by weight of (a) + (b) + (c).

35 40. Thermoplastic material according to any one of claims 37 to 39, further comprising a radical initiator (e).

41. Thermoplastic material according to claim 40, wherein the radical initiator is an organic peroxide selected from: t-butyl perbenzoate, dicumyl peroxide, benzoyl

peroxide, di-t-butyl peroxide, or mixtures thereof.

42. Thermoplastic material according to claim 40 or 41, wherein the radical initiator (e) is present in an amount of from 0.01% by weight and 1% by weight, with
5 respect to 100 parts by weight of (a) + (b) + (c).

43. Manufactured product comprising a thermoplastic material according to any one of the preceding claims.

44. Manufactured product according to claim 43, said manufactured product being selected from: industrial,
10 sport or safety surfaces; flooring tiles; sound barriers; shoe soles; automotive floor mats; automotive bumpers; automotive locary; pipes or hoses materials; roofing materials; geomembranes.